

Chapter 2. Ozone Air Quality Impacts

This section summarizes the results of estimating ambient ozone concentrations for the 2007 base case and the 2007 control scenario for the Section 126 Rule. EPA used a regional-scale version of the Urban Airshed Model (UAM-V) with the emissions changes presented in Chapter 9 of EPA's RIA to estimate ozone air quality. UAM-V was the primary modeling tool relied upon by the OTAG process that provided the foundation for the air quality modeling conducted for the NO_x SIP call. Because it accounts for spatial and temporal variations as well as differences in the reactivity of emissions, the UAM-V is useful for evaluating the impacts of the final Section 126 rule on ozone concentrations in that area of the eastern U.S. covered by this analysis (i.e., the OTAG region as explained in Chapter 10 of the RIA). Our analysis applies the modeling system for a base-year of 1995 and for two future-year scenarios: a 2007 base case and a 2007 policy scenario. As discussed in Chapter 10 of the RIA, we used the 1995 base-year model predictions in conjunction with ambient air quality observations from 1995 to calibrate the model. Using the methods identified and described in Chapter 11 of the RIA, the air quality impacts listed above are then associated with human populations and ecosystems to estimate changes in health and welfare effects.

The UAM-V modeling system requires several input files that contain information pertaining to the modeling domain and simulation period. These include gridded, day-specific emissions estimates and meteorological fields, initial and boundary conditions, and land-use information. For this benefits analysis, EPA modeled the same domain representing the eastern U.S. as that used in EPA's "Regulatory Impact Analysis for the NO_x SIP Call, FIP, and Section 126 Petitions." This regional domain is segmented into grids, each of which has several layers of air conditions that are considered in the analysis. Using this data, the UAM-V model generates predictions of hourly ozone concentrations for every grid. EPA used the results of this process to develop future year ozone profiles at monitor sites by applying derived adjustment factors to the actual 1995 ozone data at each monitor site. For areas (grids) without ozone monitoring data, we interpolated ozone values using data from monitors surrounding the area. After completing this process, we calculated daily and seasonal ozone metrics as inputs for the health and agriculture end points of the benefits analysis.

2.1 Ozone Air Quality Results

This section summarizes the predicted ambient ozone concentrations from the UAM-V model for the 2007 base case and changes associated with the final 126 rulemaking. Table 2-1 provides the ozone air quality impacts for those metrics that serve as inputs for the health benefits end-points. These metrics include:

Seasonal 8-Hour Average,
Daily 1-Hour Maximum,
Daily 5-Hour Maximum,

Daily 24-Hour Average, and
Daily 12-Hour Average.

Except for the daily 24-hour average, these ozone metrics are calculated over relevant time periods during the daylight hours (7 am to 7 pm) of the “ozone season,” i.e., May through September. For the 8-hour average, the relevant time period is 9 am to 5 pm, and, for the 5-hour maximum, it is 10 am to 3 pm.

As shown in Table 2-1, the measures of central tendency (e.g., mean, median, and population-weighted mean) for each ozone metric decline as a result of this rulemaking, while the tails of the distribution (e.g., minimum and maximum) demonstrate negligible increases. The mean seasonal 8-hour average ozone concentrations across all population grid-cells in the OTAG region declines by roughly 1.5 percent, or 0.6 ppb. A slightly higher relative decline of 2.2 percent, or 0.85 ppb, is predicted for the population-weighted average, which indicates rather uniform reductions in these concentrations across urban and rural areas. Similar absolute and relative changes are observed across the other ozone metrics listed in Table 2-1.

Alternatively, Table 2-2 provides the ozone air quality impact for the SUM06 metric that serves as the input for the welfare benefits end-points (i.e., agriculture). The impact of the Section 126 rule on the seasonal SUM06 ozone metric is significantly greater than on the health benefits-related metrics. The average across all counties in the OTAG region declines by just over 11 percent, or 1.5 ppb, while the population-weighted average declines by 9.4 percent, or 1.7 ppb. However, the median value increases by almost 7 percent, or 0.7 ppb, which corresponds to increases in the upper tail of the distribution as evidenced by the slight rise in the maximum value by roughly 0.7 percent, or 0.5 ppb.

Table 2-1.
Summary of UAM-V Derived Ozone Air Quality Impacts for Health Benefits End-Points:
Section 126 Rulemaking

| <i>Statistic ^a</i> | <i>2007 Base Case</i> | <i>Change ^b</i> | <i>Percent Change ^b</i> |
|--|-----------------------|----------------------------|------------------------------------|
| <i>Seasonal 8-Hour Average Concentration (ppb)</i> | | | |
| Minimum ^c | 19.00 | 0.10 | 0.53% |
| Maximum ^c | 65.80 | 0.20 | 0.30% |
| Average | 37.63 | -0.57 | -1.52% |
| Median | 37.80 | -0.65 | -1.72% |
| Population-Weighted Average ^d | 38.87 | -0.85 | -2.18% |
| <i>Daily 1-Hour Maximum Concentration (ppb)</i> | | | |
| Minimum ^c | 23.61 | 0.06 | 0.23% |
| Maximum ^c | 85.22 | 0.11 | 0.12% |
| Average | 47.73 | -0.70 | -1.47% |
| Median | 47.77 | -0.76 | -1.59% |
| Population-Weighted Average ^d | 51.42 | -1.09 | 2.12% |
| <i>Daily 5-Hour Maximum Concentration (ppb)</i> | | | |
| Minimum ^c | 19.62 | 0.03 | 0.15% |
| Maximum ^c | 67.00 | 0.12 | 0.17% |
| Average | 37.64 | -0.56 | -1.50% |
| Median | 37.82 | -0.59 | -1.57% |
| Population-Weighted Average ^d | 38.73 | -0.83 | -2.14% |
| <i>Daily 24-Hour Average Concentration (ppb)</i> | | | |
| Minimum ^c | 11.96 | 0.02 | 0.17% |
| Maximum ^c | 49.21 | -0.33 | -0.66% |
| Average | 29.57 | -0.30 | -1.00% |
| Median | 29.68 | -0.30 | -1.00% |
| Population-Weighted Average ^d | 29.37 | -0.44 | -1.49% |
| <i>Daily 12-Hour Average Concentration (ppb)</i> | | | |
| Minimum ^c | 17.62 | 0.03 | 0.14% |
| Maximum ^c | 62.44 | 0.14 | 0.22% |
| Average | 37.01 | -0.55 | -1.49% |

| | | | |
|--|-------|-------|--------|
| Median | 37.24 | -0.53 | -1.43% |
| Population-Weighted Average ^d | 38.10 | -0.81 | -2.14% |

^a These ozone metrics are calculated at the CAPMS gridcell level for use in health effects estimates based on the results of enhanced spatial interpolation. Except for the daily 24-hour average, these ozone metrics are calculated over relevant time periods during the daylight hours (7 am to 7 pm) of the “ozone season,” i.e., May through September. For the 8-hour average, the relevant time period is 9 am to 5 pm, and, for the 5-hour maximum, it is 10 am to 3 pm.

^b The change is defined as the control case value minus the base case value. The percent change is the “Change” divided by the “2007 Base Case.”

^c The base case minimum (maximum) is the value for the CAPMS gridcell with the lowest (highest) value.

^d Calculated by summing the product of the projected 2007 CAPMS gridcell population and the estimated 2007 CAPMS gridcell seasonal ozone concentration, and then dividing by the total population.

Table 2-2.
Summary of UAM-V Derived Ozone Section 121(b) Outputs for Welfare Benefits End-Points:

| <i>Statistic ^a</i> | <i>2007 Base Case</i> | <i>Change ^b</i> | <i>Percent Change ^b</i> |
|--|-----------------------|----------------------------|------------------------------------|
| <i>Sum06 (ppb)</i> | | | |
| Minimum ^c | 0.00 | 0.003 | --- |
| Maximum ^c | 69.22 | 0.47 | 0.68% |
| Average | 12.30 | -1.38 | -11.22% |
| Median | 10.27 | 0.71 | 6.91% |
| Population-Weighted Average ^d | 17.72 | -1.66 | -9.37% |

^a SUM06 is defined as the cumulative sum of hourly ozone concentrations over 0.06 ppm (or 60 ppb) that occur during daylight hours (from 8am to 8pm) in the months of May through September. It is calculated at the county level for use in agricultural benefits based on the results of enhanced spatial interpolation.

^b The change is defined as the control case value minus the base case value. The percent change is the “Change” divided by the “2007 Base Case.”

^c The base case minimum (maximum) is the value for the county level observation with the lowest (highest) concentration.

^d Calculated by summing the product of the projected 2007 county population and the estimated 2007 county level ozone concentration, and then dividing by the total population.

